DOCUMENT RESUME

ED 175 427 IR 007 591

AUTHOR Reigeluth, Charles M.; And Others
TITLE A Summary of the Final Report on the Structural Strategy Diagnostic Profile Project.
INSTITUTION Courseware, Inc., Provo, Utah.
SPONS AGENCY Navy Personnel Research and Development Center, San Diego, Calif.
PUB DATE Jul 78
CONTRACT CW-0245-31; N00123-76-C-0245
NOTE 16p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Electronics; *Instructional Design; *Instructional Improvement; *Instructional Systems; *Military Training
IDENTIFIERS Elaboration Model of Instruction; *Elaboration Theory

ABSTRACT

This project summary explains the development of the elaboration model of instruction, an alternative approach to standard instructional sequencing. There were two phases to the project--the theory construction phase, which identifies the instructional variables, postulates cause-effect relationships, and proposes optimal configurations of instructional conditions and methods through the construction of a model (or theory); and the application phase, which includes the application of the instructional model to the design of a course in a subject-matter area and the development of procedures for implementing this model in the design of new instruction. Four major products of the project are described: (1) an instructional model for sequencing, synthesizing, and summarizing related parts of a subject matter; (2) taxonomy of the variables that are included in the model; (3) a set of procedures for designing instruction, based on the instructional model; and (4) a "blueprint" illustrating the application of those procedures for the redesign of the Navy's Basic Electricity and Electronics course. (RAO)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

- ED175427

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

A SUMMARY OF THE FINAL REPORT ON THE STRUCTURAL STRATEGY DIAGNOSTIC PROFILE PROJECT

July 1978

This project was funded by
The Navy Personnel Research and Development Center
San Diego, California

The project was conducted by
Courseware, Incorporated, Research Division
Provo, Utah

Charles M. Reigeluth, Principal Investigator
M. David Merrill
Brent G. Wilson
Reginald T. Spiller
Robert Norton

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Charles Reigeluth

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Contract No. N00123-76-C-0245, CW-0245-31

IR007591

The purpose of the Structural Strategy Diagnostic Profile Project was to develop a superior alternative to the standard instructional sequencing designs based on the current methods of hierarchical task analysis. Hierarchical task analysis procedures result in an instructional sequence that begins with highly fragmented and "meaningless" small pieces of a subject matter content. This parts-to-whole instructional sequence is highly inconsistent with recent knowledge about how learning occurs most effectively. Ausubel's subsumption theory and its more recent outgrowth, schema theory, attribute much importance to cognitive structures. It is important for new learning to be related to existing cognitive structures, and it is important for the content that is being learned to be presented in a way such that stable new cognitive structures are formed through the processes of subsumption and successive differentiation. This is not to deny that learning prerequisites exist; it merely affirms that most learning prerequisites are not a useful basis for structuring a whole course.

This project resulted in the development of an alternative called the elaboration model of instruction.

PROCEDURES AND PRODUCTS

Section 1 of the Final Report on the Structural Strategy Diagnostic Profile Project describes the procedures that were used to develop the elaboration model of instruction, and it lists the products of the project.

Procedures

There were two major phases of the project: a theory-construction phase and an application phase.

The theory-construction phase entailed three distinct yet interrelated activities which were performed in a cybernetic, non-linear sequence: (1) the identification of instructional variables that are of importance for sequencing (ordering), synthesizing (interrelating), and summarizing (previewing and reviewing) related parts of a subject matter; (2) the postulation of cause-and-effect relationships (i.e., principles) among those variables; and (3) the construction of a model (or theory) that proposes optimal configurations of instructional method variables for different sets of conditions, based largely on the postulated principles.

The application phase entailed two distinct but again related and cybernetic, non-linear activities: (1) the development of procedures for implementing the instructional model in the design of new instruction, and (2) the application of those procedures to the preparation of a "blueprint" for a specific course.

Products

There were four major products of the project: two for each phase.

The theory-construction phase resulted in the production of (1) a description of the elaboration model of instruction, a model for sequencing, synthesizing, and summarizing related parts of a subject matter, and (2) a description and classification

(i.e., a taxonomy) of the variables which are included in that model. An additional but minor product of this phase was a list of postulated principles which guided the construction of the model.

The application phase of the project resulted in the production of (1) a set of procedures for designing instruction, based on the instructional model, and (2) a "blueprint" showing the result of using those procedures for the redesign of the Navy's Basic Electricity and Electronics course. An additional but minor product of this phase was a comparison of this "blueprint" with a "blueprint" of the current structure of the same course.

RESULTS OF THE PROJECT

Section 2 of the Final Report presents the four major products mentioned above: (1) the taxonomy of variables, (2) the elaboration model, (3) a set of design procedures, and (4) a "blueprint" of a course. The two minor products are also presented in Section 2: (1) a list of postulated principles, and (2) a comparison of the new "blueprint" with the old structure of the same course.

Taxonomy of Variables

The first thing we present in this part of Section 2 is a general-level classification scheme that serves two purposes: (1) it provides a framework for conceptualizing the effects of different methods of instruction under different conditions, and (2) it shows the context of structural strategies within the

larger realm of instructional strategies. This general-level classification scheme (see Figure 1) divides the world of instruction into conditions, methods, and outcomes. Conditions are those factors which both (a) cannot be manipulated and (b) interact with methods to influence outcomes. Methods are the diverse ways to achieve different outcomes under different conditions. And outcomes are all of the various effects that provide a measure of the value of alternative methods under different conditions, including effects on personnel and institutions. It is stated that we are only interested in structural strategies and in the specific conditions which interact with them.

Insert Figure 1 about here

Second, the importance of clearly defining and classifying instructional variables and concepts is emphasized. It is indicated that the nature of the classifications and the preciseness of their definition will have a large impact on progess in developing better methods for sequencing and synthesizing instruction. An important requirement for such progress is to break down methods of instruction into their building blocks, and to base one's research and theories or models on those more precise and clearly-defined strategy components.

Third, the variables relating to structural strategies are defined and classified. They are summarized in Figure 2.

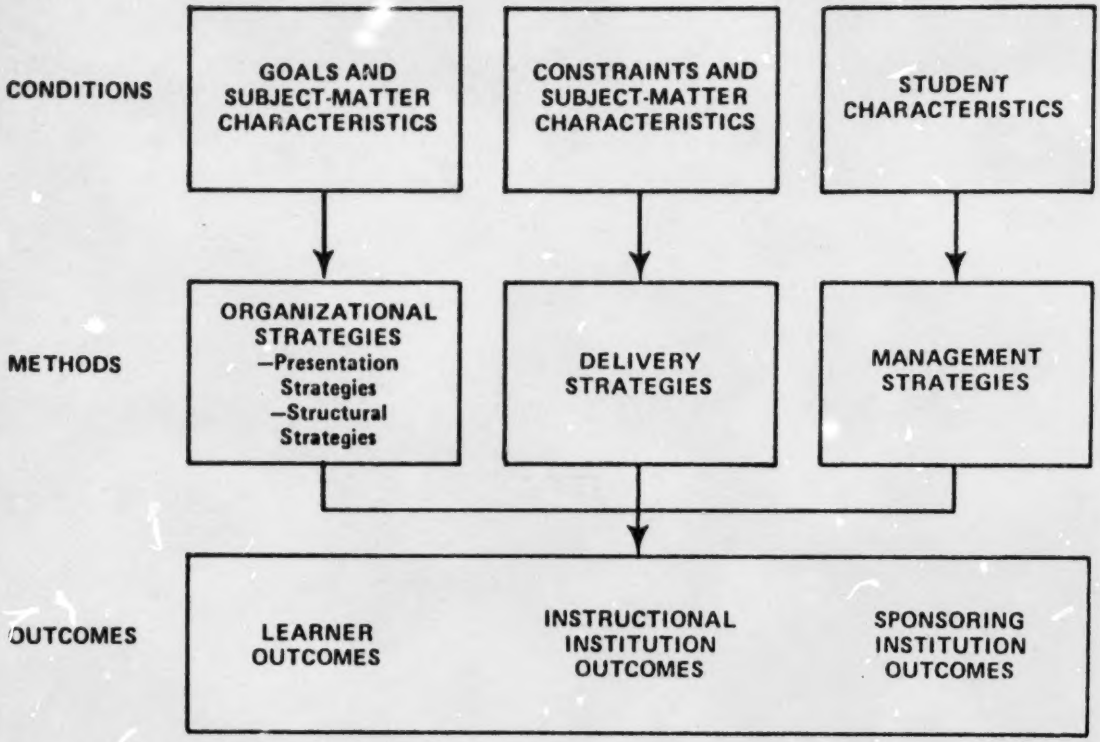

Figure 1 A model showing classes of instructional variables and the major relationships among these.

Insert Figure 2 about here

Postulated Principles

Next, we present some postulated principles of instruction, representing what we presently believe are the most important causal relations in the area of structural strategies. These include: (1) the initial synthesis principle, (2) the gradual elaboration principle, (3) the "most important first" principle, (4) the optimal size principle, (5) the periodic synthesis principle, (6) the type of synthesizer principle, and (7) the periodic summary principle.

The Elaboration Model

This part of Section 2 of the Final Report describes the elaboration model of instruction. First, we distinguish two kinds of models and express the need for a model which describes a way to achieve some end in instruction. Since general goals (ends)--such as effectiveness, efficiency, and appeal--do not vary much from course to course, the elaboration model for structuring instruction is fairly constant in related aspects. But since particular goals (ends)--such as conceptual, procedural, or theoretical orientations--do vary from course to course, the elaboration model varies from course to course with respect to related aspects. This conceptual/procedural/theoretical distinction is one of the most important advances of our model.

Second, we present the zoom-lens analogy to facilitate an understanding of the nature of our model of instruction.

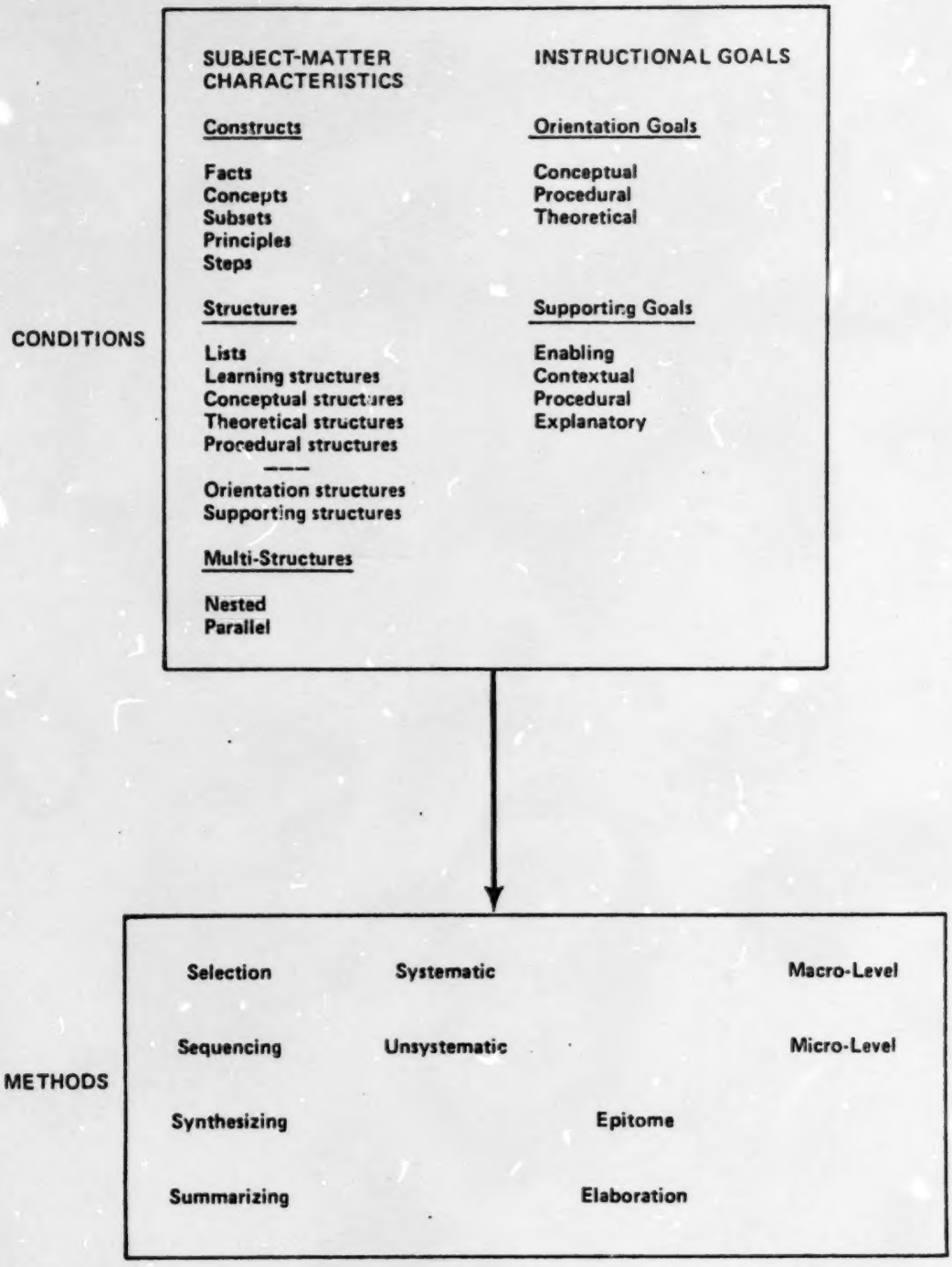

Figure 2 A summary of the classifications of variables that relate to structural strategies.

A student starts with a wide-angle view of the subject matter and proceeds to zoom in for more detail on each part of that wide-angle view, occasionally zooming back out for context and synthesis. In some cases, it may be best for a learner to pan across the entire subject matter on one level of the zoom before zooming in for more detail on any single area, whereas in other cases it may be best for the learner to continue to zoom in all the way on one area before zooming in at all on any of the other areas. In still other cases, it may be best to let the student follow his interests, as long as he uses a zoom-in pattern rather than a zoom-out pattern. We refer to our model as the elaboration model of instruction because it always follows a pattern of starting with general knowledge and gradually zooming in for more detail.

Third, the basic unvarying components of the elaboration model of instruction are described: an epitome (which is a special kind of overview), the primary-level elaborations with their internal synthesizers, a summarizer and expanded epitome following each primary-level elaboration, the secondary-level elaborations with their internal synthesizers, the summarizer and expanded epitome following each secondary-level elaboration, and a terminal epitome summarizing the entire course content, including interrelationships.

Finally, we describe the variations of the elaboration model for different courses. Some different patterns of sequencing, including learner control, are briefly mentioned. Then the nature of the epitome, the expanded epitome, the elaborations, and the internal synthesizers are described for each kind of

orientation: conceptual, procedural, and theoretical. And finally, we discuss the use of diverse multi-structures in a subject matter as a basis from which to design and organize the instruction.

Design Procedures

The next part of Section 2 of the Final Report describes a set of procedures for applying the elaboration model to the design of instruction. It is important to remember that the procedures that we are talking about are just procedures for planning the basic structure or framework of the course (i.e., selection, sequencing, synthesizing, and summarizing strategies). These procedures do not include such other considerations as strategies for presenting each individual topic, for delivering the instruction (e.g., media), or for managing the instructional process, which are also very important.

There are six steps in the basic design procedure for structuring a course (see Figure 3). Included is a description of variations in the procedure for each kind of orientation goal: conceptual, procedural, and theoretical.

Insert Figure 3 about here

Course "Blueprint"

In the next part of Section 2 of the Final Report, the six-step design procedure is illustrated with its application to the redesign of the Navy's Basic Electricity and Electroncis course.

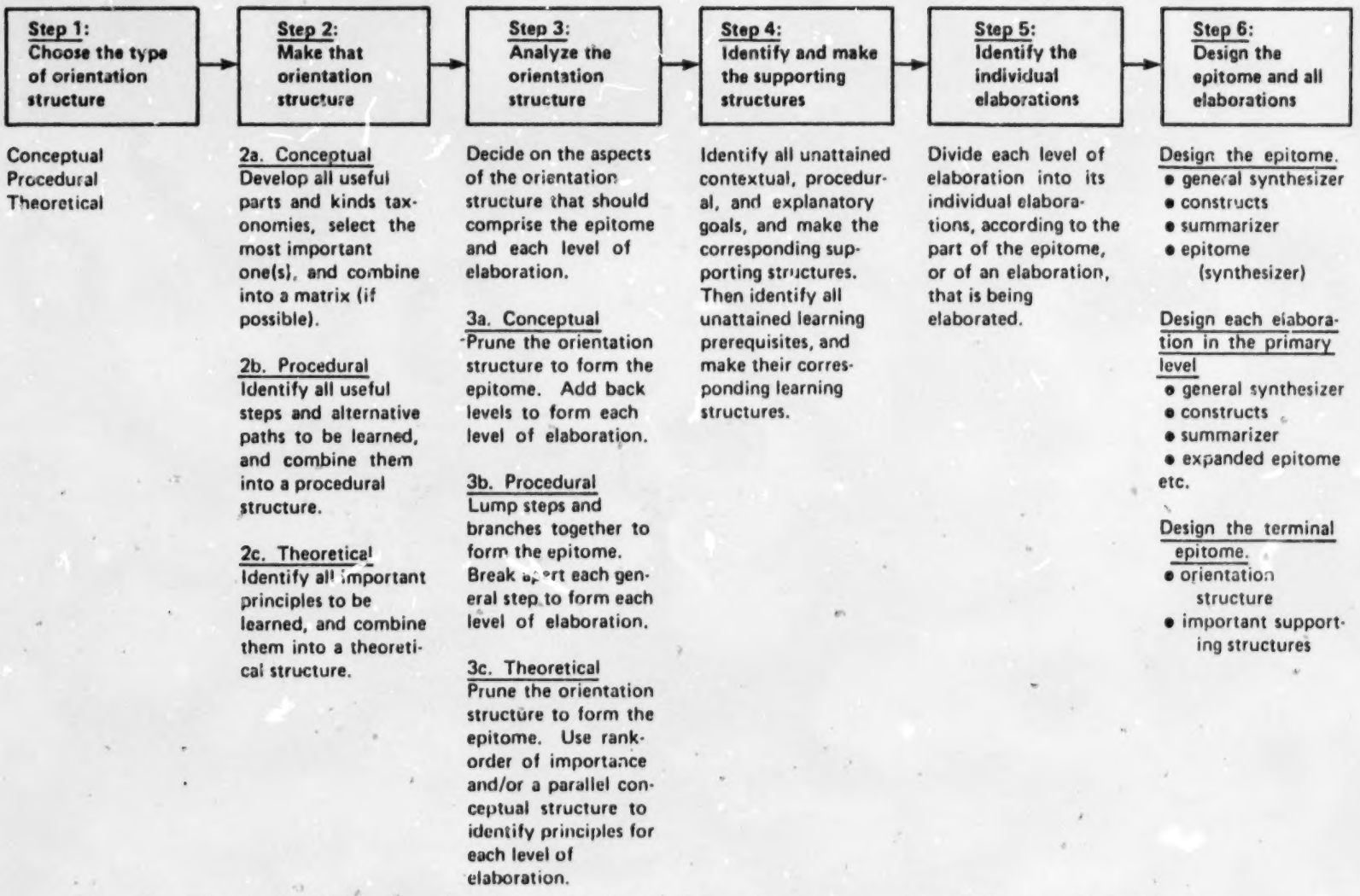
Step 1:
Choose the type of orientation structure
Step 2:
Make that orientation structure
Step 3:
Analyze the orientation structure
Step 4:
Identify and make the supporting structures
Step 5:
Identify the individual elaborations
Step 6:
Design the epitome and all elaborations
Conceptual
Procedural
Theoretical
2a. Conceptual
Develop all useful parts and kinds taxonomies, select the most important one(s), and combine into a matrix (if possible).
2b. Procedural
Identify all useful steps and alternative paths to be learned, and combine them into a procedural structure.
2c. Theoretical
Identify all important principles to be learned, and combine them into a theoretical structure.
Decide on the aspects of the orientation structure that should comprise the epitome and each level of elaboration.
3a. Conceptual
Prune the orientation structure to form the epitome. Add back levels to form each level of elaboration.
3b. Procedural
Lump steps and branches together to form the epitome. Break apart each general step to form each level of elaboration.
3c. Theoretical
Prune the orientation structure to form the epitome. Use rank-order of importance and/or a parallel conceptual structure to identify principles for each level of elaboration.
Identify all unattained contextual, procedural, and explanatory goals, and make the corresponding supporting structures. Then identify all unattained learning prerequisites, and make their corresponding learning structures.
Divide each level of elaboration into its individual elaborations, according to the part of the epitome, or of an elaboration, that is being elaborated.
Design the epitome.
• general synthesizer
• constructs
• summarizer
• epitome (synthesizer)
Design each elaboration in the primary level
• general synthesizer
• constructs
• summarizer
• expanded epitome
etc.
Design the terminal epitome.
• orientation structure
• important supporting structures

Figure 3 The six-step design procedure for structuring the instruction in any course entailing cognitive subject matter.

This illustration culminates in a "blueprint" of the redesigned course. In addition to illustrating the design procedure, it serves to illustrate the nature of the elaboration model. But perhaps even more importantly, the application of the design procedure served as an important field-test of the design procedure and of the elaboration model, and it led to considerable improvements in both.

Comparison of "Blueprints"

In the last part of Section 2 of the Final Report, we outlined the organization of the Navy's current Basic Electricity and Electronics course in order to facilitate a comparison of the elaboration approach with a hierarchical approach to instructional design. The hierarchical design starts mostly with the trivial and is characterized by a notable lack of integration or synthesis of the content.

APPLICABILITY TO NAVY TRAINING

Section 3 of the Final Report discusses the applicability and importance of the elaboration model to Navy training. The elaboration model and its design procedures are highly applicable to Navy training and are highly important to Navy training. They are equally applicable and important for teaching highly cognitive (academic), far-transfer types of skills and content as they are for teaching more rote procedures and practices. Most higher-cognitive, far-transfer types of skills and content have a theoretical orientation and can very profitably be taught with a theoretical epitome and subsequent levels of elaboration ac-

cording to the model. Most of the fairly rote procedures and practices have a procedural oreintation and can very profitably be taught with a procedural epitome and subsequent levels of elaboration.

The importance of the elaboration model for Navy training lies both in the inadequacies of the hierarchical method for structuring a course and in the effectiveness with which the elaboration model overcomes those inadequacies. The major reason for the inadequacy of the current hierarchical method is that learning hierarchicies are only one aspect of the structure of subject matter content. Therefore, at best it represents a very incomplete basis upon which to make decisions about sequencing that content. Also, of all the aspects of the structure of subject matter content, learning hierarchies are the only one that is totally useless for synthesizing the content. In addition, the parts-to-whole sequence of the hierarchical method conflicts with knowledge about how effective learning takes place--namely, the formation of stable cognitive structures through the processes of subsumption and successive differentiation.

The elaboration model emphasizes the analysis of the organization or structure of the subject matter. This is an important improvement in the theory of instructional design because it provides clarity in the understanding of relationships that provide an important basis for making decisions about good sequencing and synthesizing strategies. Being able to make

consistently good decisions about sequencing and synthesizing strategies makes possible a level of instructional effectiveness, efficiency, and appeal that was previously unattainable. The elaboration model should have a significant effect in reducing training time in a criterion-referenced setting and thus should significantly reduce training costs.

FURTHER INVESTIGATIONS

Section 4 of the Final Report describes the need for continued work on the elaboration model and its design procedures. Although we feel very good about the results of the project--both the elaboration model and the design procedures--it is important to remember that both are still in their infancy and that much additional work needs to be done, such as: (1) research on the elaboration model to determine which aspects of it are strong and which are weak, (2) further development of the elaboration model to improve it, (3) extensive field-testing of the design procedure, (4) further development and refinement of the design procedures, and (5) evaluations comparing the elaboration model as a whole to the popular hierarchical alternative.

Of all these activities, field-testing and related research on the resulting product are most strongly advocated as top priorities.